

OBSERVATIONS ON *CHAMAESYCE* (EUPHORBIACEAE)
IN THE GALÁPAGOS ISLANDS

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ABSTRACT

All collections of the endemic species of *Chamaesyce* in the Galápagos Islands were reexamined. Results indicate that hybridization has taken place in several localities, notably on Isla Bartolomé. Plants previously referred to *C. nummularia* and *C. bindloensis* from Bartolomé are considered to be of hybrid origin, and *C. bindloensis* is placed in synonymy under *C. punctulata*, together with two other names that had been overlooked in the treatment of *Chamaesyce* in the Flora of the Galápagos Islands.

The genus *Chamaesyce* has recently been revised for the Galápagos Islands (Burch 1969, 1971). While carrying out ecological studies on the islands, the junior author noticed several aberrant populations that he was unable to identify. We therefore decided to study all available specimens of the native, endemic species in an attempt to place these populations and to clear up some other problems that had become apparent.

Isla Bartolomé is a tiny islet (1.24 km²) that is situated about 200 m from the east coast of San Salvador (572 km²). The island consists of lava flows and a few cinder and tuff cones and supports a sparse vegetation of low shrubs dominated by several species of *Chamaesyce* and *Tiquilia* (= *Coldenia*, Boraginaceae, see Richardson 1976). The island seems unusually rich in species of *Chamaesyce* for its size, and Burch (1971) reports five species from here: *C. amplexicaulis*, *C. punctulata*, *C. viminea*, *C. bindloensis*, and *C. nummularia* var. *nummularia*. Of these, the first three also occur on San Salvador, as does *C. recurva*, which has not yet been reported from Bartolomé. John Thomas Howell collected numerous specimens of *Chamaesyce* on Bartolomé in 1932 (CAS, many duplicates in MO) that had not yet been incorporated into the herbarium at CAS at the time the "Flora of the Galápagos Islands" (Wiggins and Porter 1971) was in preparation and consequently were not seen by Burch. Most of these specimens do not clearly fit into one or the other of the species, but exhibit a full range of intermediate characteristics between the species *C. amplexicaulis*, *C. punctulata*, and *C. recurva* in leaf shape, pubescence, cyathial appendages, and seed shape and surface. The following note by Howell is attached to each of these sheets: "Part of the hybrid complex involving *EE. amplex-*

icaulis, *nummularia*, and *punctulata* that grew at the northwest point of Bartholomew Island. The plants grew in volcanic ash among lava rocks in a narrow belt less than 100 m long. The individuals varied in habit, vestiture, gland-appendages, and seeds, while the leaves varied in size, shape, margin, and color. *Chamaesyce bindloensis* may have been one of the elements in the complex."

We agree with Howell's note that extensive hybridization occurs on Bartolomé, as is clear from his own collections as well as several others made by Wiggins & Porter and Fagerlind & Wibom. It seems much more likely to us, however, that *C. nummularia* is not involved in the hybrid complex, but that *C. amplexicaulis* is. The collection from Bartolomé that has been identified as *C. nummularia* (Wiggins and Porter 307, DS) differs from that species by the sessile leaves and more angular and slender seeds. It is better interpreted as part of the hybrid complex. True *C. nummularia* appears to be confined to the southern islands of Santa Fé, Santa María, San Cristóbal, and Española.

Howell evidently considered *C. nummularia* to be a contributor to the hybrid complex because of the presence of hybrid individuals with hirsutulous indument similar to that of *C. nummularia*. However, although *C. amplexicaulis* is usually completely glabrous, occasional plants from such islands as Marchena (*v.d. Werff* 2132, CAS), Pinta (Stewart 1847, CAS), San Salvador (Stewart 1853, CAS; Howell 10013, CAS, MO), and Bartolomé (Howell 10063, CAS; Wiggins and Porter 308, CAS) are hirsutulous. Thus, *C. amplexicaulis* occurs near the hybrid zone, as *C. nummularia* does not, and all of the variation in the complex can be explained without involving *C. nummularia*. Furthermore, *C. amplexicaulis* is the only species that can provide the cordate-clasping leaf-bases that are observed in several of the hybrid individuals. *Chamaesyce punctulata* is also represented on San Salvador, just across from Bartolomé, by several hirsutulous collections (Howell 10054, 10055, 10056, CAS), although this species is normally glabrous.

Table 1 gives the relevant characters of the three species contributing to the hybrid complex, as well as of *C. nummularia*; the same characters for eight hybrid individuals chosen to illustrate the full range of variability are also given.

The other species that Burch reported from Bartolomé, *Chamaesyce bindloensis*, is problematical. We have examined the type (Stewart 1868, GH, lectotype, chosen by Burch 1969; CAS, isolectotype), and it is our opinion that this species, originally described as a wide-leaved variety of what is now called *C. punctulata*, falls within the range of variation exhibited by *C. punctulata*. The prominent gland appendages that are said to characterize *C. bindloensis* are not found on all cyathia. Furthermore, specimens that have the characteristic

short, broad leaves and short stipules of *C. bindloensis* but that have the ridged seeds of *C. punctulata* are known from other locations (e.g., east coast of Santa Cruz, *v.d. Werff* 2094, CAS, U; Plaza, *Fagerlind and Wibom* 3361, 3386, S). Because there is no clear-cut distinction between the two concepts, we do not hesitate to place *C. bindloensis* in synonymy under *C. punctulata*. Other specimens that have been identified as *C. bindloensis* are *C. punctulata* (e.g., *A. and H. Adersen* 1144, C), *C. recurva* (e.g., *M. and O. Hamann* 981, C) and part of the hybrid complex on Bartolomé (e.g., *Fagerlind and Wibom* 3482, 3505, S; *Wiggins and Porter* 300, DS; 304, CAS, GH and 311, MO). Thus in addition to the hybrid populations, Bartolomé supports three species of *Chamaesyce*, *C. amplexicaulis* (e.g., *Howell* 10065, CAS, MO; *Harling* 5369, S), *C. punctulata* (e.g., *Wiggins and Porter* 294, CAS, MO; *Fagerlind and Wibom* 3483, S), and *C. viminea* (e.g., *A. and H. Adersen* 1887, C).

Reports of *Chamaesyce nummularia* from Isla Wolf in the far northwestern part of the archipelago (*Snodgrass and Heller* 11, DS; *Dawson s.n.*, DS; *Stewart* 1855, CAS; *Fosberg* 44967, MO) are based on specimens that appear morphologically intermediate between *C. amplexicaulis* and *C. nummularia*. These specimens are probably of hybrid origin, but it is doubtful that *C. nummularia* is involved, since that species is known with certainty only from the four southeasternmost islands. Further collections as well as more detailed field observations will be needed in order to elucidate the nature of these puzzling plants.

Another probable hybrid population occurs on Isla Pinzón, represented in herbaria by *Howell* 9845 (CAS—4 sheets, MO) and 9846 (CAS), and noted by the collector to be variable in the field. These specimens are similar to *C. punctulata*, but have conspicuous cyathial appendages, and the seeds are, for the most part, smooth, unlike the ridged seeds of typical *C. punctulata*. The leaves exhibit a prominent dimorphy (large on main stems, small on laterals) that is suggestive of *C. recurva*, as are the large stipules. Again, further collections are needed to make a definitive interpretation.

Chamaesyce abdita was known to Burch only from the type collection on Santa Fé. It is now represented by several collections from Santa Cruz (*A. and H. Adersen* 248, C; *Howell* 9128, 9129, CAS, MO; *v.d. Werff* 1121, CAS), Baltra (*Howell* 9955, CAS, MO), Española (*A. and H. Adersen* 666, C), and Champion near Santa María (*A. and H. Adersen* 1459, C; *v.d. Werff* 2059, U). Some of these collections, especially those from Champion, have glabrous capsules and herbage and thus would not key out properly in the Flora. *Howell* 9130 (CAS, MO) from Santa Cruz has the pubescence, leaf shape, and leaf size of *C. abdita*, but is perennial. Some of the seeds are typical of *C. abdita*, but a few are ridged like those of *C. recurva*,

TABLE 1. CHARACTERISTICS OF THE SPECIES CONTRIBUTING TO, OR THAT HAVE BEEN THOUGHT TO CONTRIBUTE TO, THE HYBRID COMPLEX ON BARTOLOMÉ (LINES 1-4) AND OF SELECTED HYBRID INDIVIDUALS (LINES 5-12).

Taxon or specimen	Vegetative pubescence	Leaf shape	Leaf base	Cyathial appendages	Capsule pubescence	Seed shape	Seed surface
1. <i>C. amplexicaulis</i>	glabrous or hirsutulous	suborbicular	cordate-clasping obtuse	conspicuous	glabrous or hirsutulous	plump	smooth
2. <i>C. recurva</i>	glabrous	ovate-obovate or lanceolate	obtuse	inconspicuous	glabrous	angular	bluntly ridged
3. <i>C. punctulata</i>	glabrous	linear-lanceolate	rounded	inconspicuous	glabrous	angular	prominently ridged
4. <i>C. nummularia</i> var. <i>nummularia</i>	hirsutulous	orbicular to broadly ovate	rounded to subcordate	inconspicuous	hirsutulous	plump	smooth
5. <i>Howell 10070</i> (CAS)	lvs. glabrous stems nearly so	ovate	subcordate	intermediate	glabrous	angular	smooth
6. <i>Howell 10076</i> (CAS)	hirsutulous	deltate-orbicular	cordate-clasping	intermediate	glabrous to hirsutulous	plump or slightly angular	smooth
7. <i>Howell 10077</i> (CAS)	slightly hirsutulous	deltate-ovate	rounded to cordate-clasping	intermediate	glabrous to hirsutulous	angular	smooth
8. <i>Howell 10084</i> (CAS)	hirsutulous	lanceolate-ovate	oblique	lacking	hirsutulous	angular	ridged
9. <i>Fagerlind & Wiggins & Porter 3482</i> (S)	hirsutulous	deltate-ovate	rounded to subcordate	inconspicuous	glabrous	angular	ridged
10. <i>Wiggins & Porter 300</i> (DS)	glabrous	ovate	subcordate	inconspicuous	glabrous	angular	ridged
11. <i>Wiggins & Porter 307</i> (CAS)	hirsutulous	deltate-ovate	oblique	lacking	glabrous	angular	ridged
12. <i>Wiggins & Porter 311</i> (MO)	hirsutulous	ovate	cordate	lacking	glabrous	angular	ridged

and therefore our identification of this specimen as *C. abdita* is with some hesitation.

Following is a list of native species in the Galápagos that we accept, along with synonymy that differs from that given by Burch (1969, 1971), including two published names that were not accounted for by Burch. These are *Euphorbia bisulcata* Howell, Proc. Calif. Acad. Sci., 4th ser., 21:330, 1935; type: *Howell 9880* (CAS, holotype; MO, isotype), which differs from typical *C. punctulata* only in that the back of each carpel on the mature capsule is broadly bisulcate; and *Euphorbia howellii* Wheeler, Contr. Gray Herb. 124:42, 1939, nomen novum for *E. diffusa* Hook. f., non Jacq., a synonym of *E. punctulata*.

CHAMAESYCE ABDITA Burch

C. AMPLEXICAULIS (Hook. f.) Burch

C. GALAPAGEIA (Robins. & Greenm.) Burch

C. NUMMULARIA (Hook. f.) Burch var. NUMMULARIA

C. NUMMULARIA var. GLABRA (Robins. & Greenm.) Burch

C. PUNCTULATA (Anderss.) Burch

C. bindloensis (Stewart) Burch

Euphorbia articulata Anderss. var. *bindloensis* Stewart

E. bisulcata Howell

E. diffusa Hook. f., non Jacq.

E. howellii Wheeler

C. RECURVA (Hook. f.) Burch

C. VIMINEA (Hook. f.) Burch

One additional adventive species, *Chamaesyce lasiocarpa* (Kl.) Arthur, has been found on the islands since the Flora was published (San Cristóbal, *v.d. Werff 2171*, U, van der Werff, 1977).

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